MANAGING BEEF COWS DURING COLD STRESS

K-STATE Research and Extension

Cow-calf producers generally recognize that severe winter weather increases cattle nutrient requirements. The practical questions that must be asked when managing cowherds through cold stress events are "What is cold to a cow?," "What nutrients should be increased and by how much?," and "How should the feeding program be adjusted?"

What is cold to a beef cow?

Cattle are most comfortable and perform optimally when effective temperatures are neither too warm nor too cold. This is referred to as thermoneutral. Effective ambient temperatures are what the temperature feels like. Beef cows begin to experience cold stress when effective ambient temperatures drop below the lower critical temperature (Table 1). Once effective temperatures are below this point, the cow must generate additional heat to maintain her body temperature.

Table 1. Estimated lower critical temperatures for beef cows*

Coat Condition	Lower Critical Temperature (°F)
Wet (all hair lengths) or summer coats	59
Dry, fall coat	45
Dry, winter coat	32
Dry, heavy winter coat	18

* In a 5.0 body condition score.

Effective ambient temperatures account for windchill, humidity, and solar radiation. Lower critical temperatures are influenced by both environmental (wind speed, precipitation, humidity) and animal (hair depth or thickness, hide thickness, the amount of mud present on the hair, body condition score) factors. Table 2 explains windchill effects accounting for wind speeds and temperatures. These effects are based on a beef cow with a body condition score 5 and a dry, winter hair coat. For more information about body condition scores, see the K-State Research and Extension publication *Guide to Body Condition Scoring Beef Cows and Bulls*, MF3274, (*https://bookstore.ksre.ksu.edu/pubs/MF3274.pdf*).

The Kansas Mesonet (*https://mesonet.k-state.edu/agriculture/animal/*) is a resource for both current and forecasted cold stress conditions for cattle in Kansas. Information from the Kansas Mesonet accounts for humidity and solar radiation factors. In wet conditions, some cows begin experiencing cold stress around 60 degrees Fahrenheit, which would be a mild winter day. For cows with a heavy winter coat, the estimated lower critical temperature under dry conditions is about 18 degrees Fahrenheit. Cold to a beef cow is when the effective ambient temperature is something less than the established lower critical temperature.

What nutrients should be increased and by how much?

Cold stress increases the energy required for a cow to maintain her body temperature. As energy demands increase, there is no clear effect on protein, mineral, or vitamin requirements. The energy needs of a cow in a body condition score 5 or greater with a dry hair coat increase by 1% for each degree Fahrenheit below the lower critical temperature. For example, if the lower critical temperature were 32 degrees Fahrenheit and she requires 12.0 pounds of TDN (total digestible nutrients) every day, then her needs would increase to 13.2 pounds if the effective temperature were 22 degrees Fahrenheit. The following steps show this calculation.

1. 32°F (lower critical temperature) – 22°F (effective temperature) = 10-degree difference.
2. A 10-degree difference is a 10% increase in TDN, which equals 1.2 lb (12 lb × 0.10.)
3. 1.2 lb + 12.0 lb = 13.2 lb TDN needed per day, accounting for cold stress when dry.

If she has a wet coat, regardless of hair length, then energy requirements increase by 2% for each degree below the lower critical temperature. For a cow requiring 12.0 pounds of TDN, her energy needs increase by 74% with a wet hair coat (lower critical temperature of 59 degrees Fahrenheit) and a 22-degree Fahrenheit effective temperature (59 – 22 = 37 × 2 = 74).

Table 2. Windchill factors for beef cows*

Wind Speed (mph)	Air Temperature (°F)												
	-10	-5	0	5	10	15	20	25	30	35	40	45	50
	Effective Windchill Temperature (°F)												
Calm	-10	-5	0	5	10	15	20	25	30	35	40	45	50
5	-16	-11	-6	-1	3	8	13	18	23	28	33	38	43
10	-21	-16	-11	-6	-1	3	8	13	18	23	28	33	38
15	-25	-20	-15	-10	-5	0	4	9	14	19	24	29	34
20	-30	-25	-20	-15	-10	-5	0	4	9	14	19	24	29
25	-38	-32	-27	-22	-17	-12	-7	-2	2	7	12	17	22
30	-46	-41	-36	-31	-27	-21	-16	-11	-6	-1	3	8	13
35	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
40	-78	-73	-68	-63	-58	-53	-48	-43	-38	-33	-28	-23	-18

*with a dry, winter coat and body condition score 5.0.

How should the feeding program be adjusted?

Feeding additional pounds of an average-quality hay typically offsets increased energy needs during periods of moderate cold stress (Tables 3 and 4). In cases of severe or prolonged cold stress, hay alone is usually not sufficient. Providing additional energy by feeding higher-quality, more energy-dense feedstuffs may be required.

Using the previous example of the cow that needs 12.0 pounds of TDN and has a 74% increase in energy needs, feeding the following additional as-fed amounts daily would be a practical approach to offset the increase: 3.5 pounds of average quality grass hay + 6 pounds of dried distillers grains + 3 pounds of whole corn.

When supplementing grains such as corn, wheat, or sorghum, avoid feeding more than 0.5% of body weight daily. This reduces forage digestion issues and risks of founder. When first introducing grain, start at 0.25% of body weight daily, and any increases in supplemental grains should be introduced slowly and gradually, especially when exceeding the 0.5% of body weight rate.

Consider using feedstuffs with highly digestible fiber and lower starch content such as distillers grains, wheat middlings, soybean hulls, or corn gluten feed. Beef cows in a confinement or pen-fed setting typically respond to cold stress by increasing voluntary forage intake. However, beef cows on pasture may spend less time grazing during cold stress events, which reduces forage intake and makes it challenging to meet the cow's additional energy needs solely through voluntary forage intake. It is critical that cows have access to sufficient water during cold stress events because water restrictions further reduce forage intake and subsequent body heat production.

Important points to consider when managing cowherds through cold stress

1. Body condition is key; cows in a body condition score of 5 or greater are better able to withstand cold stress.
2. It is difficult to add body condition after calving, even more so during cold weather.
3. Thin cows (body condition score ≤ 4.0), cows without wind protection, and with wet hair coats are at greatest risk.
4. The lower critical temperatures are simply a guide for when cold stress may occur.
5. When dry, energy requirements increase 1% for each degree Fahrenheit below the lower critical temperature.
6. When wet, energy requirements increase 2% for each degree Fahrenheit below the lower critical temperature.
7. Start with conservative amounts of grains (0.2% of body weight) and gradually increase.
8. Feed low-starch feedstuffs, such as distillers grains or wheat middlings as first choices.
9. Provide bedding to help insulate cold, frozen ground surfaces.
10. Ensure cows have sufficient access to clean, fresh water.

Table 3. Example feeding scenarios for pre-calving beef cows for offsetting additional energy needs due to cold stress.[1]

		Last 3 Months Pre-Calving (base TDN needs = 13.4 lb/day)		
Effective Temp. (°F)	Energy Increase, %	TDN Increase, lb/day	Extra Hay Needed, lb/day[2]	+ Extra DDGS Needed, lb/day[3]
32.0	0	0	0	0
22.0	10	1.3	2.5	0
12.0	20	2.7	5.5	0
2.0	30	4.0	5.0	2.0
-8.0	40	5.4	4.5	4.0
-18.0	50	6.7	3.5	6.0

[1]Assuming a 1,400 lb cow, dry, winter hair coat and 5.0 body condition score.
[2]As-fed amounts of 56% TDN (total digestible nutrients) hay at 90% dry matter.
[3]As-fed amounts of DDGS (corn dried distillers grains plus solubles).

Table 4. Example feeding scenarios for post-calving beef cows for offsetting additional energy needs due to cold stress.[1]

		First 3 Months Post-Calving (base TDN needs = 17.0 lb/day)		
Effective Temp. (°F)	Energy Increase, %	TDN Increase, lb/day	Extra Hay Needed, lb/day[2]	+ Extra DDGS Needed, lb/day[3]
32.0	0	0	0	0
22.0	10	1.7	3.5	0
12.0	20	3.4	7.0	0
2.0	30	5.1	5.5	3.0
-8.0	40	6.8	5.5	5.0
-18.0	50	8.5	5.5	7.0

[1]Assuming a 1,400 lb cow, dry, winter hair coat and 5.0 body condition score.
[2]As-fed amounts of 56% TDN (total digestible nutrients) hay at 90% dry matter.
[3]As-fed amounts of DDGS (corn dried distillers grains plus solubles).

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